Food and Agriculture Organization
of the United Nations

MEASUREMENT OF PROGRESS TOWARDS SDGS

A statistical approach for assessing progress towards the SDG targets

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The problem

Monitoring achievements toward the targets of the 2030 Agenda:

- assessing the **current** status, as reflected by the latest available SDG data ("**distance to the target**")
- assessing the **future** status, whether the SDG target will be reached by 2030 (i.e. **comparing the future value of the indicator with the target**)

Some leading regional/international agencies have developed and adopted different assessment approaches. This leads to:

↳ sometimes inconsistent or contradictory results

↳ risk to generate uncertainty and confusion among the users

Different kind of assessments

In particular, different approaches are adopted depending on the following aspects of the assessment:

- Time dimension:
  - **"current status"** or
  - **"future status**" (future value of the indicator wrt the target)

- Level of analysis:
  - **National or regional/global**
  - **Single indicator or group of indicators under the same Target/Goal**

Assessing the Current Status (1/3)

Assessing the "current" status: monitor the current level of achievement as described by the latest available data. Different approaches

Given the distribution of the indicator by country, compare the Country value with those of other countries:

- OECD (2019): z-score (distance to the target compared to variability of the "current" status)
- SDSN (2019): relative distance wrt to the worst value among countries
- FAO (2020): (normalized) distance to the target, wrt to the maximum distance (partly adopted in the 2020 UN progress Chart)

Assessment only at regional level, current situation compared to the baseline year:

- UN ESCAP (2017): baseline status index approach. Proportion of the distance to the target travelled from the baseline year to the latest year. Closer to an assessment of progress over time.

Assessing the "Current" Status (2/3)

Data needed:

- Values of the SDG indicator for each country (*i*) in the current year (last available data point): x_{it}
- **Target** value of the generic SDG indicator: x^*
- UN ESCAP needs also the value of indicator for each region in the "**baseline**" year (t_0): x_{it_0}

Major difficulties:

SDG indicators without a numerical target. Different solutions:

- OECD, SDSN, UN ESCAP set a "statistical" target (Targets are set by policy-makers, not statisticians; Moreover, setting a target may not make sense for some indicators, e.g. 15.1.1 - Forest area as a % of land area)
- FAO: does **NOT** set a "statistical" target, just estimates the empirical distribution and assigns to each country the corresponding position in the distribution (quintile)

Assessing the "Current" Status (3/3)

Major difficulties (cont.d):

Geographical Aggregation:

- OECD, SDSN: weighted average using country's population as weight (regional/global assessment influenced by most populous countries)
- FAO: simple average/median (each country has an equal weight = 1) accompanied by measures of variability (range, interquartile range, etc.)

Aggregation by Target/Goal:

- OECD, SDSN: simple average
- FAO: **NOT** done (averaging does not solve problems of heterogeneity and redundancies between indicators under the same target/Goal)

Assessing the "Future" Status (1/4)

- Eurostat (2019), SDSN (2019) and FAO compare **Actual growth vs Required growth** to reach the target in 2030:

$$R = \frac{actual\ growth}{required\ growth}$$

- SDSN assumes a linear growth model
- Eurostat and FAO (and the 2020 UN Progress Chart) adopt a geometric growth model
- Assessment based on a system of thresholds for the different values of *R*

Ratio of actual and required growth rate	SDSN Assessment category
$R \geq 1$	On track or maintaining SDG achievement
$0.50 < R \leq 1$	Moderately improving
$0 \leq R \leq 0.5$	Stagnating
$R < 0$	Decreasing

Ratio of actual and required growth rate	FAO's Assessment category
$R \geq 0.95$	On-track to achieve the target
$0.10 < R < 0.95$	On path but too slow to achieve the target
$-0.10 \leq R \leq 0.10$	No improvement (stagnation) since baseline year
$R < -0.10$	Deterioration/Movement away from the target

Assessing the "Future" Status (2/4)

OECD (2019) carries out a statistical test to detect the presence of monotonic upward or downward trend over time

The test is based on the Spearman's rank correlation coefficient (r_i) (i.e. ranks instead of values offer protection against outliers, nonparametric)

When the desired direction is the increase over time, the following rule is adopted:

Values of Spearman's rank correlation coefficient	Assessment category
$r_i < -0.20$ **AND significant at 10% level**	Country *i* moving away from the target
$-0.20 \leq r_i \leq +0.20$ **OR NOT significant at 10% level**	no trend identified for Country *I*
$r_i > +0.20$ **AND significant at 10% level**	Country *i* progressing toward the target

the 1st and 3rd categories should be inverted when the "normative" direction is the decrease over time.

Unfortunately the test may be unreliable in presence of serial correlation

Assessing the "Future" Status (3/4)

UN ESCAP (2017) also adopts a geometric growth model

The estimation of the compound annual growth rate is achieved by using a weighted geometric mean, with weights decreasing over time (higher weighs for more recent values)

The estimated annual growth rate is used to get a prediction of the indicator value in the year 2030.

Then the forecasted 2030 value is compared to the target (*anticipated progress index*)

UN ESCAP approach uses all the data in the time series, giving more importance to most recent values, but is not applicable in the presence of missing values or too short time series.

Assessing the "Future" Status (4/4)

Forecasting approach:

- Fit a model => get 2030 forecasts => compare forecasts with the target
  - Linear trend models, ARIMA, …
  - Exponential Smoothing model ….
  - ……..

Problems:

- Requires relatively long time series (>=10 years, better longer time series)
- It is unlikely that the same model fits adequately to each country data. In this case, smoothing may represent a valid alternative for getting forecasts country by country

Models should behave better when fitted to regional/global aggregated time series (better in terms of signal-to-noise ratio)

Difficulties in assessing the trend (1/3)

Data needed by FAO, SDSN & Eurostat approaches (and 2020 UN SDG progress Chart):

a) Values of SDG indicator in the "current" year *t* (last available data point): x_{it}
b) value of indicator in the "**baseline**" year (t_0): x_{it_0}
c) target value of the generic SDG indicator: x^* (FAO and Eurostat only for indicators with an explicit numerical target)

Data needed by OECD and UN ESCAP (and forecasting-based approaches):

a) All data points in the time series, from the "baseline" (t_0) the "current" (t) year
b) target value (x^*) of the generic SDG indicator (only for UN ESCAP)

Difficulties in assessing the trend (2/3)

SDG indicators without a numerical target. Different solutions:

- SDSN and UN ESCAP set a "statistical" target
- FAO and Eurostat: do **NOT** set a "statistical" target, just estimate the actual growth (numerator of *R*) and judge it according to the normative direction of the given SDG indicator

Example SDG 2.a.1 FAO

Criteria to judge the actual growth (CAGR)

Values of actual growth rate	Color	Assessment category
$CAGR_a > 0.01$	Dark green	Improvement since baseline-year (>>)
$0.005 < CAGR_a \leq 0.01$	Light green	Slight improvement since baseline-year (>)
$-0.005 \leq CAGR_a \leq 0.005$	yellow	No improvement since baseline-year (=)
$-0.01 \leq CAGR_a < -0.005$	Orange	Slight deterioration since baseline-year (<)
$CAGR_a < -0.01$	Red	Deterioration since baseline-year (<<)

- **OECD's approach does NOT require having a target!**

Difficulties in assessing the trend (3/3)

Geographical Aggregation:

- SDSN: weighted average using country's population as weight
- FAO: works directly on regional time series (as being more accurate) to estimate R or CAGR and provide measure of heterogeneity within the region
- OECD: summarizes progress at regional/global level by counting how many countries in the region show the same assessment (e.g. "moving away from the target").

Aggregation by Target/Goal:

- SDSN and Eurostat: simple average
- FAO: **NOT** done (averaging does not solve problems of heterogeneity and redundancies between indicators under the same target/Goal)
- OECD: summarizes progress at target/goal level by counting how many indicators show the same assessment (similar to the geographical

General Problems: Outliers (extreme values)

Assessment of the current status:

- Choice of the worst value in the current year (SDSN, FAO)
- Estimation of the standard deviation (OECD)
- Estimation of the "statistics" SDG target (when not explicitly set in the 2030 Agenda) (OECD, SDSN)
- **possible solutions**: remove outliers before calculation OR adopt robust estimators (e.g. Median Absolute Deviation)

Assessment of the trend over time:

- Affect the estimation of growth rates
- **possible solutions**: robust estimation and/or nonparametric techniques (e.g. Sen's slope or OECD approach, being based on ranks, are not affected by outliers)

General Problems: missing values, type of variables, …

- Time series too short (mainly 4-5 data points): only basic methods based on estimation of actual/required growth are applicable (no models for forecasting, no test for trend detection, etc.)
- Data gaps:
  - If missing values are in the middle of the time series then the calculation of actual/required growth rates is NOT affected
  - If missing values are at the beginning or at the end of the time series then the assessment may not be comparable or may not be feasible
  - Not possible to calculate the regional aggregates
- Type of data: e.g. SDGs expressed as scores require ad hoc procedures (categorize possible combinations of scores and monitor change over time of the categories).

Thank you
for your attention!